PB-239 701

KELLY'S FALLS POND, HILLSBOROUGH COUNTY, NEW HAMPSHIRE

Pacific Northwest Environmental Research Laboratory

Prepared for:

New Hampshire National Guard
New Hampshire Water Supply and Pollution Control Commission
National Environmental Research Center

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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivded according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

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REPORT
ON
KELLY'S FALLS POND
HILLSBOROUGH COUNTY
NEW HAMPSHIRE
EPA REGION I
WORKING PAPER No. 13

WITH THE COOPERATION OF THE
NEW HAMPSHIRE WATER SUPPLY AND POLLUTION CONTROL COMMISSION
AND THE
NEW HAMPSHIRE NATIONAL GUARD

AUGUST, 1974

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FOREWORD

The National Eutrophication Survey was initiated in 1972 as a research project in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to fresh water lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the New Hampshire Water Supply and Pollution Control Division for professional involvement and to the New Hampshire National Guard for conduct of the tributary sampling phase of the Survey.

William A. Healy, Executive Director of the New Hampshire Water Supply and Pollution Control Commission, Ronald E. Towne, Water Pollution Biologist, and Kenneth MacDonald, Chief Water Pollution Sanitarian, provided invaluable lake documentation and counsel during the course of the Survey.

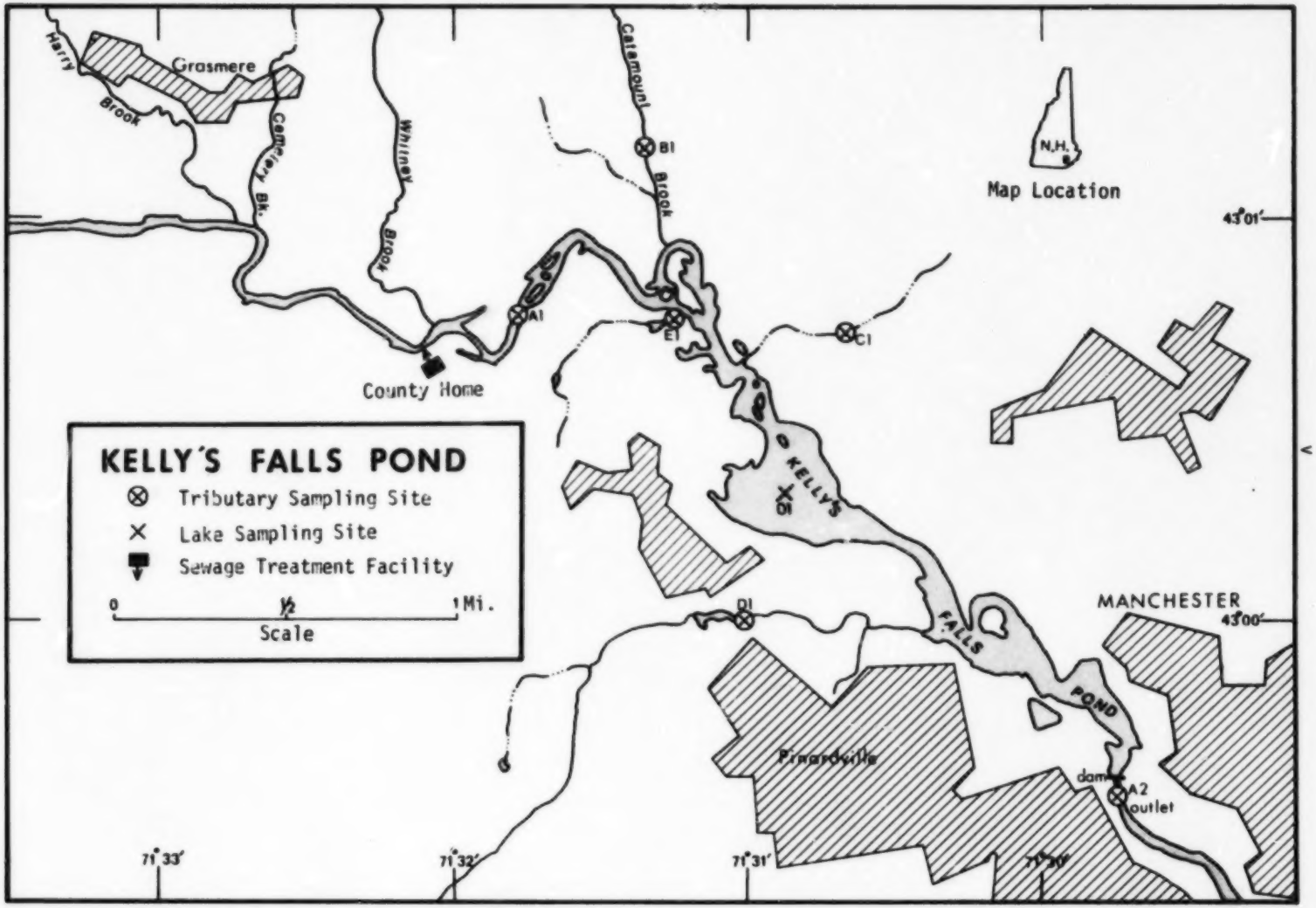
Major General Francis B. McSwiney, the Adjutant General of New Hampshire, and Project Officer Lieutenant Colonel Russ Grady, who directed the volunteer efforts of the New Hampshire National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF NEW HAMPSHIRE

LAKE NAME	COUNTY
Glen Lake	Hillsborough
Lake Winnipesaukee	Carroll, Belknap
Kelly's Falls Pond	Hillsborough
Powder Mill Pond	Hillsborough


Grasmere
Harry Brook
Cattley Bk.
Whitney Brook
Catamount Brook
B1
A1
E1
C1
County Home
N.H.
Map Location
43°01'
KELLY'S FALLS POND
Tributary Sampling Site
Lake Sampling Site
Sewage Treatment Facility
0
½
1 Mi.
Scale
KELLY'S
D1
MANCHESTER
43°00'
FALLS
POND
Pinardville
dam
A2
outlet
71°33'
71°32'
71°31'
71°30'

KELLY'S FALLS POND

STORET NO. 3305

I. CONCLUSIONS

A. Tropic Condition:

Survey data and the records of others show that Kelly's Falls Pond is eutrophic. Mean chlorophyll a concentrations and low Secchi disc transparencies are indicative of a eutrophic condition, but nutrient concentrations are indicative of a somewhat better trophic condition. However, the very short hydraulic retention time of the Pond is suppressing the effect of very high nutrient loading rates.

B. Rate-Limiting Nutrient:

The results of the algal assay indicate the Pond was phosphorus limited at the time the assay sample was collected. However, the Pond data indicate that nitrogen was limiting at the other sampling times.

C. Nutrient Controllability:

1. Point sources--During the sampling year, the Pond received a total phosphorus load at a rate over six times greater than the rate proposed by Vollenweider (in press) as "dangerous" (i.e., a eutrophic rate; see page 14). It is calculated that Goffstown and the Hillsboro County Home contributed about 21% of the total phosphorus load.

It is noted in "Merrimack River Basin Water Quality Management Plan" (Anonymous, 1973) that Phase I of the New Hampshire State Plan calls for a regional waste treatment plant at Manchester with an interceptor from the plant to the Hillsboro County Home and to Goffstown which will eliminate the point-source loads to Kelly's Falls Pond. However, when the regional facilities become operational, the total phosphorus load to the Pond will only be reduced to about 200 lbs/acre/yr or about 23 $g/m^2/yr$ (still about five times greater than a eutrophic rate) because of non-point, and presumably uncontrollable, phosphorus sources.

2. Non-point sources--During the sampling year, the total phosphorus exports of the streams tributary to the Pond (see page 14) were appreciably higher (mean of 93 $lbs/mi^2/yr$) than the exports of Glen Lake streams (mean of 68 $lbs/mi^2/yr$). Note, however that even if the phosphorus export of the Piscataquog River at Kelly's Falls Pond had been a very low 30 $lbs/mi^2/yr$, the drainage area/pond area ratio of 1,060/1 would have ensured a non-point source loading rate of more than 5 $g/m^2/yr$ (i.e., in excess of a eutrophic rate).

II. INTRODUCTION

Kelly's Falls Pond is located on the Piscatoquog River in northeastern Hillsborough County, New Hampshire. The Pond is approximately 2 miles in length and is situated almost immediately downstream from Glen Lake. The dams impounding the two water bodies are only about five stream miles apart, and the Glen Lake outlet sampling station (3306A2) is only about 1.5 stream miles upstream from the Kelly's Falls Pond inlet station (3305A1).

III. LAKE AND DRAINAGE BASIN CHARACTERISTICS

A. Lake Morphometry*:

1. Surface area: 129 acres.
2. Mean depth: 7.4 feet.
3. Maximum depth: 22.0 feet.
4. Volume: 955 acre/feet.
5. Mean hydraulic retention time: 1.5 days.

B. Tributary and Outlet:
(See Appendix A for flow data)

1. Tributaries -

Name	Drainage area†	Mean flow†
Piscataquog River	212.0 mi^2	306.3 cfs
Catamount Brook	0.7 mi^2	1.0 cfs
Unnamed Stream (C-1)	0.2 mi^2	0.4 cfs
Unnamed Stream (D-1	2.9 mi^2	4.2 cfs
Minor tributaries & immediate drainage -	2.0 mi^2	3.1 cfs
Totals	217.8 mi^2	315.0 cfs

2. Outlet -

Piscataquog River	218.0 $mi^{2††}$	315.0 cfs

C. Precipitation†††:

1. Year of sampling: 45.4 inches.
2. Mean annual: 40.3 inches.

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* Anonymous, 1970.
† Drainage areas are accurate within ±1%, gaged mean annual flows within ±15%, and ungaged mean annual flows ±20%.
†† Includes area of lake.
††† See Working Paper No. 1, "Survey Methods".

IV. LAKE WATER QUALITY SUMMARY

Kelly's Falls Pond was sampled three times during the open-water season of 1972 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from a number of depths at a single station on the Pond (see map, page v). During each visit, a single depth-integrated (near bottom to surface) sample was collected for phytoplankton identification and enumeration, and a similar sample was collected for chlorophyll a analysis. During the last visit, a single five-gallon depth-integrated sample was collected for algal assays. The maximum depth sampled was 8 feet.

The results obtained are presented in full in Appendix B, and the data for the fall sampling period, when the lake was essentially well-mixed, are summarized below. Note, however, the Secchi disc summary is based on all values.

For differences in the various parameters at the other sampling times, refer to Appendix B.

A. Physical and chemical characteristics:

Parameter	Minimum	Mean	Median	Maximum
		FALL VALUES (10/04/72)		
Temperature (Cent.)	16.0	16.0	16.0	16.0
Dissolved oxygen (mg/l)	9.5	9.5	9.5	9.5
Conductivity (μmhos)	93	97	97	100
PH (units)	6.9	6.9	6.9	7.0
Alkalinity (mg/l)	10	10	10	10
Total P (mg/l)	0.028	0.035	0.035	0.042
Dissolved P (mg/l)	0.010	0.015	0.015	0.020
NO_2 + NO_3 (mg/l)	0.160	0.160	0.160	0.160
Ammonia (mg/l)	0.160	0.160	0.160	0.160
		ALL VALUES		
Secchi disc (inches)	60	70	72	77

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Number per ml
06/02/72	1. Dinobryon	208
	2. Navicula	124
	3. Achnanthes	75
	4. Synedra	69
	5. Flagellates	51
	Other genera	308
	Total	835
08/05/72	1. Dinobyron	1,627
	2. Anabaena	1,266
	3. Chroococcus	850
	4. Cyclotella	832
	5. Fragilaria	633
	Other genera	759
	Total	5,967
10/04/72	1. Flagellates	522
	2. Melosira	361
	3. Anabaena	341
	4. Dinobryon	251
	5. Cyclotella	151
	Other genera	573
	Total	2,199

2. Chlorophyll *a* -
(Because of instrumentation problems during the 1972 sampling, the following values may be in error by plus or minus 20 percent.)

Sampling Date	Station Number	Chlorophyll *a* (µg/l)
06/02/72	01	5.6
08/05/72	01	3.3
10/04/72	01	12.0

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.005	0.336	0.1
0.006 P	0.011	0.336	0.6
0.012 P	0.017	0.336	3.1
0.024 P	0.029	0.336	6.8
0.060 P	0.065	0.336	7.2
0.060 P + 10.0 N	0.065	10.336	27.4
10.0 N	0.005	10.336	0.1

2. Discussion -

The control yield of the assay alga, *Selenastrum capricornutum*, indicates that primary productivity of Kelly's Falls Pond was relatively low at the time the sample was collected. However, there was loss of about 6 µg/l of dissolved phosphorus from the time the sample was collected until the time the assay was begun. Had this loss not occurred, the control

yield probably would have been nearer 1 mg/l dry weight (moderately productive).

The increased yields with increased levels of orthophosphorus (to about 30 µg/l) show that the primary productivity of the Pond was phosphorus limited at the time the sample was collected (note that the addition of only nitrogen produced no greater yield than the control). However, the Pond data indicate that Kelly's Falls Pond was nitrogen limited in June and August (nitrogen/phosphorus ratios were 10/1 and 7/1, respectively, and nitrogen limitation would be expected).

D. Trophic Condition:

Data obtained during the Survey indicate that Kelly's Falls Pond is eutrophic. The Pond receives annual nutrient loadings of 257 lbs/acre/yr (28.8 $g/m^2/yr$) of phosphorus and over 2,600 lbs/acre/yr (292.7 $g/m^2/yr$) of nitrogen. However, the "flow-through" characteristic of the Pond (retention time of 1.5 days) is minimizing nutrient retention and thus is suppressing the effects of these excessive nutrient loadings.

V. NUTRIENT LOADINGS
(See Appendix C for data)

For the determination of nutrient loadings, the New Hampshire National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v), except for the high runoff months of March and April, when two samples were collected, and the colder months of the year when one or more samples were omitted, depending on the site. Sampling was begun in August, 1972, and was completed in August, 1973.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the New England District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were calculated using mean annual concentrations and mean annual flows. Nutrient loadings for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S) were estimated by using the means of the nutrient loads, in $lbs/mi^2/yr$, at stations B-1, C-1, and D-1 and multiplying the means by the ZZ area in mi^2.

Also, because of relatively insignificant flows and loads (P = <10 lbs; N = 80 lbs), the nutrient loads measured at station E-1 were added to the loads calculated for the minor tributaries and immediate drainage.

The Hillsboro County Home did not participate in the Survey, and nutrients loads were estimated*. The Goffstown wastewater treatment plant discharges to upstream Glen Lake**, and the nutrient loads attributed to that source were adjusted for the observed retention in Glen Lake (32% of the phosphorus and 28% of the nitrogen). In the loading tables, the nutrient loads attributed to the Piscataquog River are those measured at station A-1 minus the point-source loads.

A. Waste Sources:

1. Known municipal -

Name	Pop. Served†	Treatment	Mean Flow (mgd)	Receiving Water
Goffstown (indirect)	4,000	Imhoff	0.410	Glen Lake
Hillsboro County Home	500	Primary	0.050††	Piscataquog River

2. Known industrial - None

* See Working Paper No. 1, "Survey Methods".
** See Working Paper No. 12, "Report on Glen Lake".
† Estimated; see Working Paper No. 1.
†† Anonymous, 1973.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	lbs P/ yr	% of total
a. Tributaries (non-point load) -		
Piscataquog River	25,440	76.7
Catamount Creek	60	0.2
Unnamed Stream (C-1)	20	<0.1
Unnamed Stream (D-1)	190	0.6
b. Minor tributaries & immediate drainage (non-point load) -	170	0.5
c. Known municipal -		
Goffstown (indirect)	5,870	17.7
Hillsboro Co. Home	1,250	3.8
d. Septic tanks* -	140	0.4
e. Known industrial - None	-	-
f. Direct precipitation** -	20	<0.1
Total	33,160	100.0

2. Outputs -

Lake outlet - Piscataquog River 22,320

3. Net annual P accumulation - 10,840 pounds

* Estimated 230 shoreline residences; see Working Paper No. 1.
** See Working Paper No. 1.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	lbs N/ yr	% of total
a. Tributaries (non-point load) -		
Piscataquog River	297,850	88.4
Catamount Creek	1,010	0.3
Unnamed stream (C-1)	710	0.2
Unnamed stream (D-1)	4,560	1.4
b. Minor tributaries & immediate drainage (non-point load)	4,380	1.3
c. Known municipal STP's -		
Goffstown (indirect)	17,980	5.3
Hillsboro Co. Home	3,750	1.1
d. Septic tanks* -	5,400	1.6
e. Known industrial - None	-	-
f. Direct precipitation** -	1,240	0.4
Total	336,880	100.0

2. Outputs -

Lake outlet - Piscataquog River 394,390

3. Net annual N loss - 57,510 pounds

* Estimated 230 shoreline residences; see Working Paper No. 1.
** See Working Paper No. 1.

D. Mean Annual Non-point Nutrient Export by Subdrainage Areas:

Tributary	lbs P/mi^2/yr	lbs N/mi^2/yr
Piscataquog River	120	1,405
Catamount Creek	86	1,443
Unnamed Stream (C-1)	100	3,550
Unnamed Stream (D-1)	66	1,572

E. Yearly Loading Rates:

In the following table, the existing phosphorus loading rates are compared to those proposed by Vollenweider (in press). Essentially, his "dangerous" rate is the rate at which the receiving waters would become eutrophic or remain eutrophic; his "permissible" rate is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic rate would be considered one between "dangerous" and "permissible".

	Total Phosphorus		Total Nitrogen	
Units	Total	Accumulated	Total	Accumulated
lbs/acre/yr	257.1	84.0	2,611.5	loss*
grams/m^2/yr	28.81	9.42	292.7	-

Vollenweider loading rates for phosphorus ($g/m^2/yr$) based on mean depth and mean hydrualic retention time of Kelly's Falls Pond:

"Dangerous" (eutrophic rate)	4.40
"Permissible" (oilgotrophic rate)	2.20

* There was an apparent loss of nitrogen during the sampling year. This may have been due to nitrogen fixation in the Pond, solubilization of previously sedimented nitrogen, recharge with nitrogen-rich ground water, underestimation of point-sources nitrogen loads, or a combination of these. Whatever the cause, a similar nitrogen loss has occurred at Shagawa Lake, Minnesota, which has been studied intensively by EPA's National Eutrophication Research and Lake Restoration Branch.

VI. LITERATURE REVIEWED

Anonymous, 1970. Biological survey of the lakes and ponds in Cheshire, Hillsborough, and Rockingham counties. NH Fish & Game Dept., Concord.

Anonymous, 1973. Merrimack River basin water quality management plan. Staff Rept. #61, NH Water Supply & Pollution Control Comm., Concord.

MacDonald, Kenneth, 1973. Personal communication (physical characteristics of Kelly's Falls Pond). NH Water Supply & Pollution Control Comm., Concord.

Vollenweider, Richard A., (in press). Input-output models. Schweiz A. Hydrol.

VII. APPENDICES

APPENDIX A

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR NEW HAMPSHIRE 7/9/74

LAKE CODE 330's KELLYS FALLS

TOTAL DRAINAGE AREA OF LAKE 218.00

TRIBUTARY	SUB-DRAINAGE AREA	NORMALIZED FLOWS JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
330501	212.00	240.00	301.00	400.00	929.00	441.00	231.00	87.60	57.70	83.50	110.00	280.00	284.00	306.31
330502	218.00	248.00	310.00	617.00	955.00	453.00	238.00	90.00	59.30	85.90	113.00	288.00	292.00	314.98
330501	0.66	0.87	0.94	1.87	2.89	1.37	0.72	0.27	0.18	0.26	0.34	0.87	0.88	0.95
330501	0.26	0.34	0.36	0.71	1.10	0.52	0.27	0.10	0.07	0.10	0.13	0.33	0.34	0.36
330501	3.93	3.87	4.18	8.29	12.80	6.09	3.19	1.21	0.80	1.15	1.52	3.87	3.93	4.23
330501	0.04	0.05	0.06	0.11	0.18	0.08	0.04	0.02	0.01	0.02	0.02	0.05	0.05	0.06
330577	2.12	2.40	3.01	6.00	9.29	4.41	2.31	0.88	0.58	0.84	1.10	2.80	2.84	3.06

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 218.00
SUM OF SUB-DRAINAGE AREAS = 218.00

TOTAL FLOW IN = 3789.04
TOTAL FLOW OUT = 3789.20

MEAN MONTHLY FLOWS AND DAILY FLOWS

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
330501	9	73	46.80	26	331.00				
	9	73	32.60	24	27.60				
	10	73	77.00	28	131.00				
	11	73	447.00	18	237.00				
	12	73	483.00	9	859.00				
	1	74	360.00	27	647.00				
	2	74	502.00	10	375.00				
	3	74	1020.00	10	948.00	24	1040.00		
	4	74	1143.00	14	846.00	28	1134.00		
	5	74	631.00	19	647.00				
	6	74	244.00	23	146.00				
	7	74	355.00						
	8	74	103.00	4	413.00				
330502	9	73	48.10	26	340.00				
	9	73	33.60	24	28.30				
	10	73	79.10	28	135.00				
	11	73	551.00	18	244.00				
	12	73	496.00	9	883.00				
	1	74	370.00	27	665.00				
	2	74	520.00	10	386.00				
	3	74	1049.00	10	1016.30	24	1070.00		
	4	74	1175.00	14	870.00	28	1166.00		
	5	74	648.00	19	665.00				
	6	74	243.10	23	150.00				
	7	74	365.00						
	8	74	106.30	4	425.00				

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TRIBUTARY FLOW INFORMATION FOR NEW HAMPSHIRE 7/9/74

LAKE CODE 3305 KELLYS FALLS

MEAN MONTHLY FLOWS AND DAILY FLOWS

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
330581	8	72	0.15	26	1.03				
	9	72	0.18	24	0.24				
	10	72	0.24	28	0.41				
	11	72	1.51	18	0.74				
	12	72	1.58	9	2.67				
	1	73	1.74	27	2.01				
	2	73	1.88	10	1.17				
	3	73	3.18	10	3.08	24	3.24		
	4	73	3.50	14	2.60	28	3.50		
	5	73	2.88	19	2.08				
	6	73	0.89	23	0.50				
	7	73	1.10						
	8	73	0.32	4	1.29				
3305C1	8	72	0.06	26	0.39				
	9	72	0.04	24	0.09				
	10	72	0.09	28	0.16				
	11	72	0.57	18	0.28				
	12	72	0.58	9	1.01				
	1	73	0.66	27	0.76				
	2	73	0.72	10	0.44				
	3	73	1.21	10	1.16	24	1.23		
	4	73	1.48	14	1.00	28	1.30		
	5	73	0.74	19	0.80				
	6	73	0.33	23	0.20				
	7	73	0.42						
	8	73	0.12	4	0.49				
330501	8	72	0.65	26	4.57				
	9	72	0.45	24	1.08				
	10	72	1.06	28	1.82				
	11	72	4.73	18	3.28				
	12	72	6.68	9	11.90				
	1	73	7.74	27	8.94				
	2	73	8.32	10	5.19				
	3	73	14.10	10	13.70	24	14.40		
	4	73	15.70	14	11.70	28	15.70		
	5	73	8.70	19	8.90				
	6	73	3.90	23	2.80				
	7	73	5.00						
	8	73	1.43	4	5.71				
3305E1	8	72	0.01	26	0.06				
	9	72	0.01	24	0.02				
	10	72	0.02	28	0.03				
	11	72	0.09	18	0.05				
	12	72	0.08	9	0.16				
	1	73	0.10	27	0.12				
	2	73	0.12	10	0.07				
	3	73	0.19	10	0.19	24	0.20		
	4	73	0.22	14	0.16	28	0.21		
	5	73	0.11	19	0.12				
	6	73	0.05	23	0.03				
	7	73	0.08						
	8	73	0.02	4	0.08				

TRIBUTARY FLOW INFORMATION FOR NEW HAMPSHIRE 7/9/74

LAKE CODE 3305 KELLY'S FALLS

MEAN MONTHLY FLOWS AND DAILY FLOWS

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
3305ZZ	8	72	0.47						
	9	72	0.33						
	10	72	0.77						
	11	72	4.87						
	12	72	4.83						
	1	73	5.60						
	2	73	6.02						
	3	73	10.20						
	4	73	11.40						
	5	73	6.30						
	6	73	2.80						
	7	73	3.70						
	8	73	1.04						

APPENDIX B

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 74/07/02

330501
43 00 03.0 071 30 08.0
KELLY FALLS POND
33 NEW HAMPSHIRE

11EPALES 2111202
3 000M FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3-N TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P
72/06/02	08 50	0000	16.9	4.3	60	50	6.50	10K*	0.060	0.040	0.014	0.011
	08 50	0004	16.9	9.2		50	6.50	10K	0.070	0.040	0.018	0.010
	08 50	0008	16.8	8.6		50	6.50	10K	0.060	0.020	0.018	0.008
72/08/05	13 50	0000			77	75	6.60	10K	0.080	0.060	0.029	0.019
	13 50	0004	22.3	9.0		75	6.60	10K	0.080	0.050	0.032	0.020
	13 50	0007	22.1	8.8		75	6.50	10K	0.080	0.060	0.031	0.019
72/10/04	15 10	0000			72	100	7.00	10K	0.160	0.160	0.042	0.020
	15 10	0004	16.0	9.5		93	6.90	10K	0.160	0.160	0.028	0.010

DATE FROM TO	TIME OF DAY	DEPTH FEET	32217 CHLRPHYL A UG/L
72/06/02	08 50	0000	5.8J*
72/08/05	13 50	0000	3.3J
72/10/04	15 10	0000	12.0J

J* Value known to be in error
K* Value known to be less than indicated

APPENDIX C

TRIBUTARY DATA

STORET RETRIEVAL DATE 74/09/27

3305A1 LS3305A1
43 01 00.0 071 32 00.0
PISCATAQUOG RIVER
33 7.5 GOFFSTOWN
I/KELLYS FALLS
2 MI E GLEN LK DAM
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/08/26	14 35		0.189	0.540	0.063	0.040	0.050
72/09/24	12 05		0.180	0.900	0.054	0.038	0.082
72/10/28	11 50		0.104	0.350	0.138	0.009	0.036
72/11/18	12 20		0.099	0.520	0.115	0.009	0.039
73/01/27	13 00		0.130	0.270	0.031	0.008	0.015
73/02/10	13 30		0.113	0.420	0.028	0.005K	0.015
73/03/10			0.105	0.150	0.034	0.010	0.012
73/03/24	11 45		0.096	0.170	0.020	0.006	0.015
73/04/14	10 40		0.100	0.440	0.042	0.060	0.180
73/04/28	13 00		0.096	0.270	0.039	0.038	0.115
73/08/04	12 00		0.069	0.520	0.015	0.011	0.032

K VALUE KNOWN TO BE LESS
THAN INDICATED

STORET RETRIEVAL DATE 74/07/02

3305A2 LS3305A2
42 59 30.0 071 29 30.0
PISCATAQUOG RIVER
33 7.5 MANCHESTER S
O/KELLYS FALLS
NAZAIRE BIRON BRDG
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/08/26	10 25		0.050	1.050	0.088	0.018	0.072
72/09/24	10 00		0.150	0.600	0.147	0.010	0.038
72/12/09	08 55		0.126	0.780	0.048	0.707	
73/01/27	10 05		0.120	0.320	0.035	0.007	0.015
73/02/10	09 00		0.120	0.420	0.042	0.011	0.020
73/03/10			0.126	0.330	0.025	0.011	0.020
73/03/24	09 00		0.100	0.190	0.023	0.006	0.015
73/04/14	13 50		0.068	0.460	0.019	0.007	0.020
73/04/28	09 00		0.071	0.310	0.036	0.013	0.030
73/05/19	10 10		0.056	0.360	0.025	0.007	0.025
73/06/23	09 00		0.074	0.520	0.040	0.011	0.035
73/08/04	10 00		0.130	1.100	0.480	0.030	0.110

STORET RETRIEVAL DATE 74/07/02

3305B1 LS3305B1
43 01 00.0 071 31 30.0
CATAMOUNT BROOK
33 7.5 GOFFSTOWN
T/KELLYS FALLS LAKE
GOFFSTOWN BACK RD BRDG
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/08/26	11 00		0.286	0.730	0.057	0.030	0.063
72/09/24	10 36		0.169	0.450	0.031	0.028	0.038
72/10/28	09 30		0.013	0.700	0.058	0.012	0.027
72/11/18	09 30		0.052	0.470	0.120	0.007	0.025
73/01/27	10 40		0.035	0.290	0.054	0.006	0.010
73/02/10	10 00		0.033	0.190	0.025	0.005K	0.015
73/03/10			0.032	0.770	0.052	0.006	0.015
73/03/24	10 00		0.010K	0.180	0.021	0.005K	0.015
73/04/14	13 20		0.010K	0.220	0.006	0.005K	0.010
73/04/28	10 30		0.019	0.370	0.027	0.010	0.040
73/05/19	10 46		0.036	0.350	0.028	0.020	0.032
73/06/23	10 05		0.180	0.520	0.034	0.024	0.055
73/08/04	10 10		0.035	0.500	0.058	0.021	0.040

K VALUE KNOWN TO BE LESS THAN INDICATED

STORET RETRIEVAL DATE 74/07/02

3305C1 LS3305C1
43 01 00.0 071 30 30.0
NO NAME
33 7.5 GOFFSTOWN
T/KELLYS FALLS
DOWNSTREAM OF HOLY TRINITY CEMETARY
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/08/26	10	50	0.950	0.410	0.138	0.021	0.044
72/09/24	10	20	0.945	0.200	0.063	0.014	0.025
72/10/28	09	15	0.900	0.450	0.048	0.011	0.019
72/11/18	09	25	0.660	0.460	0.090	0.010	0.017
73/01/27	10	25	0.250	0.500	0.052	0.009	0.010
73/02/10	09	30	0.273	0.165	0.040	0.010	0.020
73/03/10			0.210	0.300	0.017	0.013	0.055
73/03/24	09	30	0.280	1.100	0.067	0.009	0.025
73/04/14	13	30	0.357	0.290	0.011	0.006	0.015
73/04/28	10	00	0.270	0.280	0.024	0.006	0.015
73/05/19	10	30	0.390	0.375	0.011	0.008	0.020
73/06/23	09	40	0.810	0.230	0.044	0.018	0.030
73/08/04	10	20	0.180	0.440	0.039	0.030	0.085

STORET RETRIEVAL DATE 74/07/02

3305D1 LS3305D1
43 00 00.0 071 31 00.0
NO NAME
33 7.5 GOFFSTOWN
T/KELLYS FALLS
ST HWY 114A JCT 0.5 MI N OF PINARDVILLE
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/08/26	14	55	0.145	1.470	0.138	0.048	0.062
72/09/24	12	55	0.320	0.700	0.115	0.030	0.061
72/11/18	12	55	0.086	0.230	0.058	0.005K	0.009
72/12/09	14	50	0.100	0.400	0.031	0.007	0.019
73/01/27	14	00	0.138	0.210	0.023	0.005K	0.005K
73/02/10	14	15	0.130	0.160	0.015	0.005K	0.010
73/03/10			0.220	0.210	0.042	0.006	0.010
73/03/24	12	00	0.048	0.180	0.025	0.005K	0.015
73/04/14	10	05	0.031	0.160	0.012	0.005K	0.005K
73/04/28	14	00	0.058	0.610	0.042	0.005K	0.020
73/05/19	13	50	0.023	0.230	0.017	0.007	0.015
73/06/23	15	10	0.025	0.710	0.028	0.012	0.035
73/08/04	11	05	0.052	0.520	0.075	0.015	0.030

K: VALUE KNOWN TO BE LESS THAN INDICATED

STORET RETRIEVAL DATE 74/07/02

3305E1 LS3305E1
43 01 00.0 071 31 30.0
NO NAME
33 7.5 GOFFSTOWN
T/KELLYS FALLS
1 MI ENE OF COUNTY HOME
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/08/26	14 15		0.167	0.740	0.180	0.018	0.058
72/09/24	12 25		0.100	0.300	0.086	0.005K	0.017
72/10/28	11 50		0.126	0.600	0.150	0.012	0.046
72/11/18	12 40		0.170	0.460	0.095	0.005K	0.016
72/12/09	14 00		0.350	1.400	0.130	0.005K	0.138
73/01/27	13 50		0.399	0.520	0.078	0.005K	0.005K
73/02/10	13 50		0.440	0.160	0.063	0.005K	0.005K
73/03/10			0.110	0.480	0.017	0.005K	0.010
73/03/24	12 00		0.380	0.150	0.044	0.005K	0.005K
73/04/14	10 20		0.330	0.330	0.034	0.005K	0.010
73/04/28	13 30		0.230	0.390	0.040	0.005K	0.020
73/05/19	13 20		0.210	0.210	0.028	0.006	0.015
73/06/23	14 50		0.252	0.480	0.126	0.015	0.035
73/08/04	11 30		0.070	0.450	0.105	0.017	0.040

K VALUE KNOWN TO BE LESS
T-AN INDICATED